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(72) Inventor: Provenzano, Calogero
90011 Bagheria (Palermo) (IT)

(74) Representative: Notaro, Giancarlo et al
c/o Buzzi, Notaro & Antonielli d'Oulx srl,
Corso Fiume 6
10133 Torino (IT)

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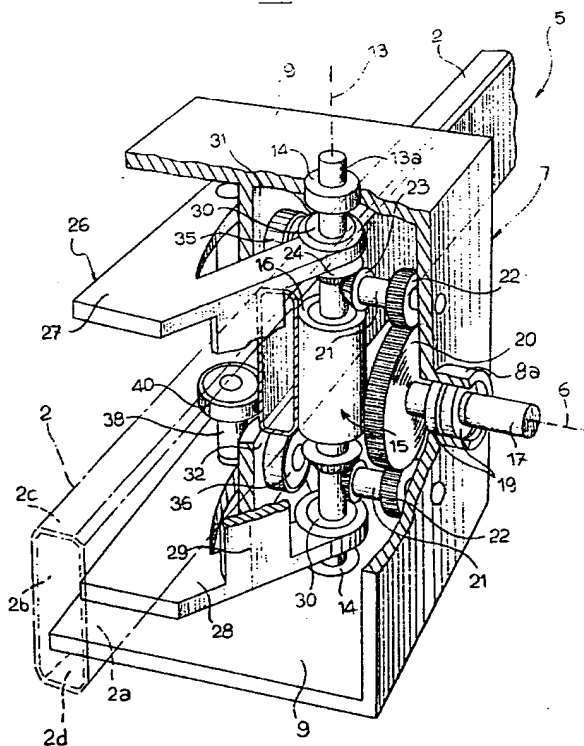
(71) Applicant: Provenzano, Calogero
90011 Bagheria (Palermo) (IT)

(54) Stair-climbing device

(57) There is described a stair-climbing device,
which can be used particularly by handicapped persons,

comprising a trolley (5) movable along a guiding rail (2)
and including a powered roller (15) which is pressed into
frictional engagement against the guiding rail (2).

Fig. 3



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Description

The present invention relates to stair-climbing devices which are used for enable a person, such as a handicapped person, to climb or coming down a stairway while being carried for example on a chair or a platform.

The object of the invention is that of providing a stair-climbing device of the above indicated type which on one hand has a relatively simple and inexpensive structure and on the other hand is safe and reliable in use as well as able of high performances.

In view of achieving this object, the invention provides a stair-climbing device, characterized in that it comprises:

- at least on guiding rail, which is to be arranged along a stairway,
- at least one trolley movable on said guiding rail, and supporting a structure for carrying a person, such as a chair or a platform,
- a powered roller supported by the trolley, which is in frictional engagement with said rail, in order to cause the trolley to move along the rail,
- a motor unit for driving the powered roller,
- one or more guiding wheels freely rotatably mounted on the trolley and adapted to engage at least the upper part of the guiding rail in order to discharge the weight of the device and the carried person at least partially on the guiding rail, and
- means for pressing the powered roller into frictional engagement against said rail, said means comprising a rocker structure pivotally supported by the trolley structure around the axis of the powered roller, and carrying at least one counter-wheel having an axis parallel to the axis of the powered roller and adapted to engage the rail on the side opposite to that engaged by the powered roller, spring means being interposed between the trolley structure and the rocker structure for holding the latter in a position in which the rail is pressed between the powered roller and said counter wheel.

Further features and advantages of the present invention will become apparent from the description which follows with reference to the annexed drawings, given purely by way of non limiting example, in which:

figure 1 is a diagrammatic view which shows the device according to the invention,
figure 2 is a cross-sectional view of a trolley forming part of the device according to the invention,
figure 3 is a perspective view, partially in cross section, of the trolley of figure 2,
figure 4 is a view in cross-section taken along line IV-IV of figure 2, and
figure 5 is a perspective view of a detail of the trolley shown in figures 2-4.

Figure 1 shows, by way of example, a preferred embodiment of the device according to the invention for which two parallel guiding rails 2 are provided along a stairway 3. The stair-climbing device according to the invention, generally designated by 1, comprises a supporting frame 4, shown only diagrammatically in the drawings) which is for supporting a structure for carrying a person, such as a chair, or a platform, which is not shown in the drawings, both because it can be made in any known way, and because it does not fall, taken alone, within the scope of the present invention, and finally also because the deletion of these details from the drawings renders the latter simpler and easier to understand.

As already indicated above, the embodiment which is shown in the drawings has two guiding rails 2. Consistently, the structure 4 of the device is provided in this case with two trolleys 5 which respectively engage the two rails 2 and are pivotally mounted on structure 4 around respective horizontal axes 6. Figure 1 shows the device 1 at a starting position at the bottom of the stairway by undotted lines on the left, and the same device at an intermediate position and at a position proximate to the final position at the top of the stairway by dotted lines, at the center and on the right of figure 1. However, it is clearly apparent that the device according to the invention could have a single guiding rail 2 and a single trolley 5, as it will be also clarified in the following.

Figures 2 through 5 show the structure of a preferred embodiment of the trolley 5. With reference to the above mentioned drawings, the trolley includes a substantially C-shaped supporting frame 7, including a vertical wall 8 and two opposite horizontal walls 9. The vertical wall 8 has a central hub 8a which is freely rotatably mounted, by means of a bearing 10, within a hole 11 of a wall 12 forming part of the supporting structure 4 of the device, to which the person carrying structure (such as a chair or a platform) is to be rigidly connected.

The two opposite walls 9 of the C-shaped frame 7 rotatably support a shaft 13a around an axis 13 orthogonal to these walls, by means of roller bearings 14, the shaft 13a carrying a powered roller 15 provided with an outer rubber layer 16 and pressed into frictional engagement with the guiding rail 2.

As shown in the drawings, each guiding rail 2 is constituted by a metal profile having a rectangular cross-section with two vertical side walls 2a, 2b, an upper wall 2c and a lower wall 2d.

The powered roller 15 can be driven in rotation by a driving shaft 17 which is rotatably supported around an axis 6 which crosses axes 13 orthogonally to the latter. The driving shaft 17 is rotatably mounted by means of roller bearings 19 within the hub 8a. The shaft 17 has one end projecting outwardly from the C-shaped frame 7 which is to be connected in rotation by means of a transmission of any known type (not shown) to an electric motor of any suitable type (not shown) fixed to the supporting structure 4. On the side opposite to its outer

end, the shaft 17 carries a toothed wheel 20 arranged inside the C-shaped frame 7, which transmits rotation to the powered roller 15 by means of two diametrically opposite shafts 21 which are freely rotatably supported by wall 8 and each carrying a toothed wheel 22 meshing with wheel 20, and a bevel gear 23 meshing with a bevel gear 24 mounted on the shaft 13a of the powered roller 15.

Reference numeral 25, in figure 2, designates a structure for supporting the guiding rail 2, shown diagrammatically, by which the rail is rigidly connected to the stairs or a wall adjacent thereto.

In order to assure the requested frictional engagement between the powered roller 15 and the guiding rail 2, the trolley 5 is provided with a rocker structure 26 (shown alone in figure 5) which includes an upper wall 27, a lower wall 28 and connecting vertical walls 29. The rocker structure 26 is freely pivotally mounted around the axis 13. In particular the walls 27, 28 are pivotally mounted on shaft 13a by means of roller bearings 30. The two walls 27, 28 have apertures 27a, 28a for avoiding interference with two arms 31, 32 which project inwardly from the opposite walls 9 of the C-shaped frame 7 and support an upper wheel 35 and a lower wheel 36 by bearing 33, 34, which wheels are freely rotatable and roll on the upper surface 2c and the lower surface 2d of the guiding rail 2, acting thereby as a guide for movement of trolley 5 along the rail 2 and also causing the entire weight of the supporting structure 4 and any person carried thereby to be discharged on the guiding rail by means of trolley 5, without stressing the powered roller 15.

Still with reference to the rocker structure 26, from the two opposite walls 27, 28 of the latter there project two coaxial pins 37, 38, whose axis is parallel to axis 13 and lies in the same plane containing axes 13, 18. On pins 37, 38 there are freely rotatably mounted two counter-wheels 39, 40 which engage the side surface 2b of rail 2 opposite to the side surface 2a engaged by the powered roller 15.

With reference to figure 4, spring means, such as a helical spring 41, are interposed between the rocker structure 26 (for example at one edge of aperture 27a of wall 27) and the C-shaped frame 7 (such as at arm 31 on which the upper guiding wheel 35 is rotatably mounted) for tending to rotate the rocker structure 26, with respect to frame 7 of trolley 5, to a position in which the guiding rail 2 is clamped from opposite sides between the powered roller 15 and the counter-wheels 39, 40. In the illustrated example, the helical spring 41 has one end received in a hole 42 formed in one edge of aperture 27a, this spring resting against a threaded grain 43 screwed into hole 42, for adjusting the load of the spring. On the opposite side, spring 41 abuts against a surface of arm 31 on which the upper guiding wheel 35 is rotatably mounted. The load of the spring means, which naturally can be made and arranged in any other way different from that which has been illustrated, is

such that the powered roller 15 is pressed against the guiding rail 2 to an extent sufficient to assure the frictional engagement. In particular, it is thus assured that when the powered roller 15 is driven in rotation it causes a translation of trolley 5 along the rail. Conversely, when the rotation of roller 15 is stopped, the pressure exchanged between roller 15 and guiding rail 2 is such to assure that the trolley is motionless relative to the rail, even considering the weight of the whole structure and any carried person, in a climbing portion of the stairs.

If desired, the counter wheels 39, 40 can be connected to the driving motor so that they also are powered wheels.

Yet with reference to figure 1, as shown the two trolleys 5 are automatically arranged with their axis 13 constantly orthogonal to the longitudinal direction of the guiding wheels 2. At the same time, since the two trolleys 5 are both freely pivotally mounted around the respective axes 6 on the same supporting structure 4, the latter always remains properly oriented.

In the case of an alternative embodiment, provided with a single guiding rail 2 and a single trolley 5, the proper orientation of the supporting structure 4 can be assured by providing for example a small motor for correcting the attitude which imparts a rotation to structure 4 such as to nullify the rotation which would be transmitted by trolley 5 when it changes its orientation while passing through portions of different inclination of the guiding rail 2.

As clearly apparent from the foregoing description, the device according to the invention is able of transporting relatively high loads safely upwardly and downwardly on even sharp stairs, at the speed which is requested in such applications. The structure of the device is also relatively simple and inexpensive.

Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

Claims

1. Stair-climbing device, particularly for handicapped persons, characterized in that it comprises:
 - at least one guiding rail (2), which is to be provided along a stairway (3),
 - at least one trolley (5) movable on said guiding rail (2), which supports a structure (4) for carrying persons, such as a chair or a platform,
 - a powered roller (15) in frictional engagement with said guiding rail (2), for causing the trolley (5) to move along the rail (2),
 - a motor unit for driving the powered roller (15),
 - one or more guiding wheels (35, 36) freely ro-

- tatably supported by the trolley (5) and adapted to engage at least the upper part of the guiding rail (2) to discharge the weight of the device and the carried person at least partially on the guiding rail, and
- means for pressing the powered roller (15) in frictional engagement against said rail (2), comprising a rocker structure (26) pivotally supported by the structure (7) of the trolley (5) around the axis (13) of the powered roller (15), and carrying at least one counter wheel (39, 40) having an axis parallel to the axis of the powered roller (15) and adapted to engage the rail (32) on the side (2b) opposite to that (2a) engaged by the powered roller (15), spring means (41) being interposed between the structure (7) of the trolley (5) and the rocker structure (26), tending to hold the latter in a position in which the rail (2) is pressed between the powered roller (15) and the counter-wheel (39, 40).
2. Stair-climbing device according to claim 1, characterized in that the structure of the trolley (5) has a C-shaped frame (7) having two opposite walls (9) which rotatably support a shaft (13a) carrying said powered roller (15), said shaft (13a) being connected to said motor unit by means of a gear transmission arranged inside the C-shaped frame (7) and having an input shaft (17) which is rotatably supported by the C-shaped frame (7) around an axis (6) which crosses the axis (13) of the powered roller (15) orthogonally thereto.
 3. Stair-climbing device according to claim 2, characterized in that said input shaft (17) is rotatably mounted within a hub (8a) of the C-shaped frame (7) of the trolley (5), said carrying structure (4) being pivotally mounted on said hub (8a) around the axis (6) of said input shaft (17).
 4. Stair-climbing device according to claim 1, characterized in that said rocker structure (26) has an upper wall (27) and a lower wall (28) rigidly connected to each other and freely rotatably mounted around a shaft (13a) carrying said powered roller (15), a pair of coaxial pins (37, 38) projecting inwardly from said upper and lower walls (27, 28) and supporting two counter wheels (39, 40) in rotation.
 5. Stair-climbing device according to claim 1, characterized in that said powered roller (15) is provided with a rubber layer (16) having a high friction coefficient.
 6. Stair-climbing device according to claim 4, characterized in that said counter wheels (39, 40) also are powered.
 7. Stair-climbing device according to claim 3, characterized in that the structure (7) of the trolley (5) has two opposite walls (9) from which two arms (31) project inwardly, which freely rotatably support an upper guiding wheel (35) and a lower guiding wheel (36) which engage an upper surface (2c) and a lower surface (2d) respectively of the guiding rail (2).
 8. Stair-climbing device according to claim 1, characterized in that two parallel and spaced apart guiding rails are provided which are vertically arranged upon each other, which are engaged by two respective trolleys (5) on which said carrying structure (4) is pivotally mounted.
 9. Stair-climbing device according to claim 1, characterized in that a single guiding wheel (2) is provided, motor means being associated with the trolley (5) for correcting the orientation of the trolley.

Fig. 1

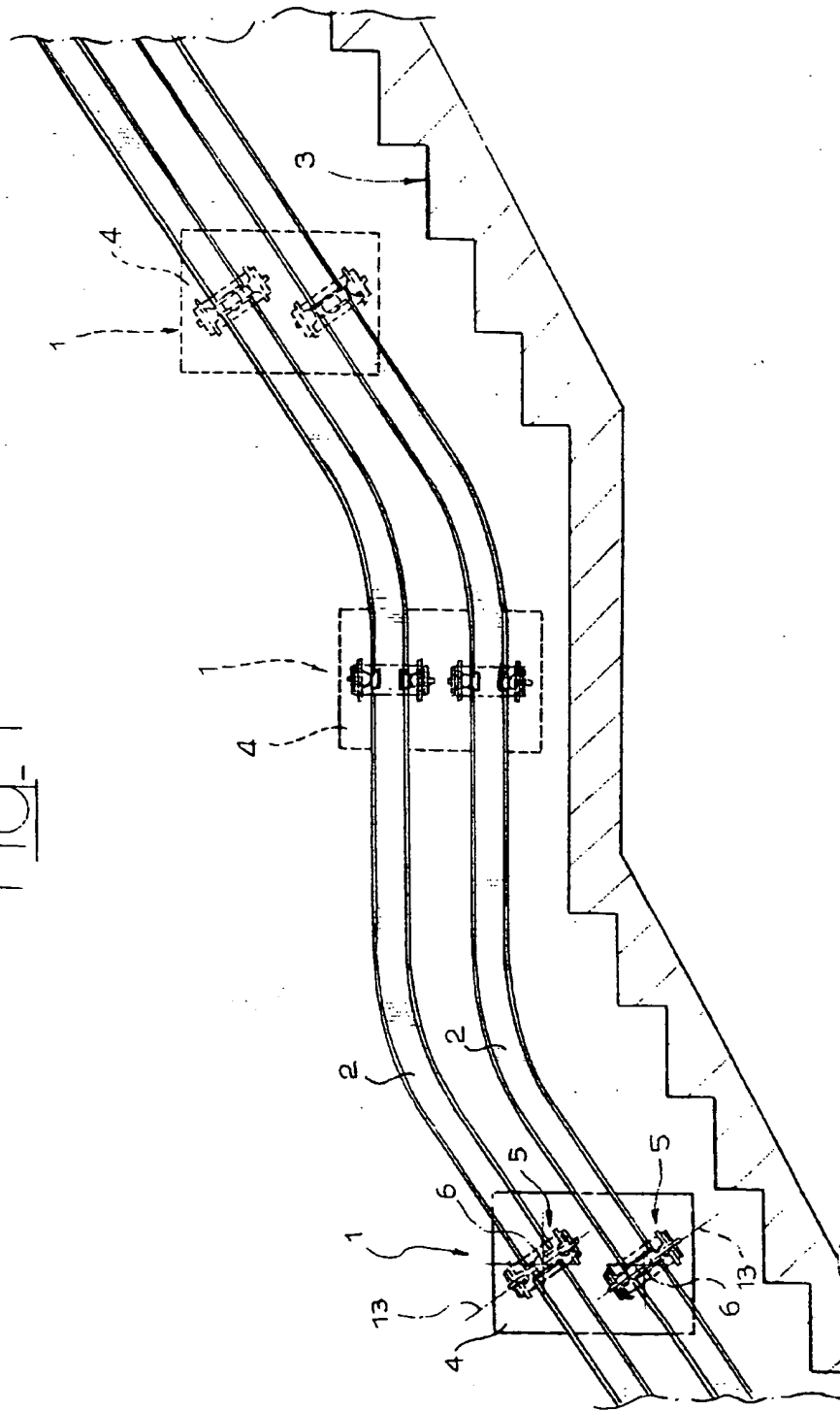


Fig. 2

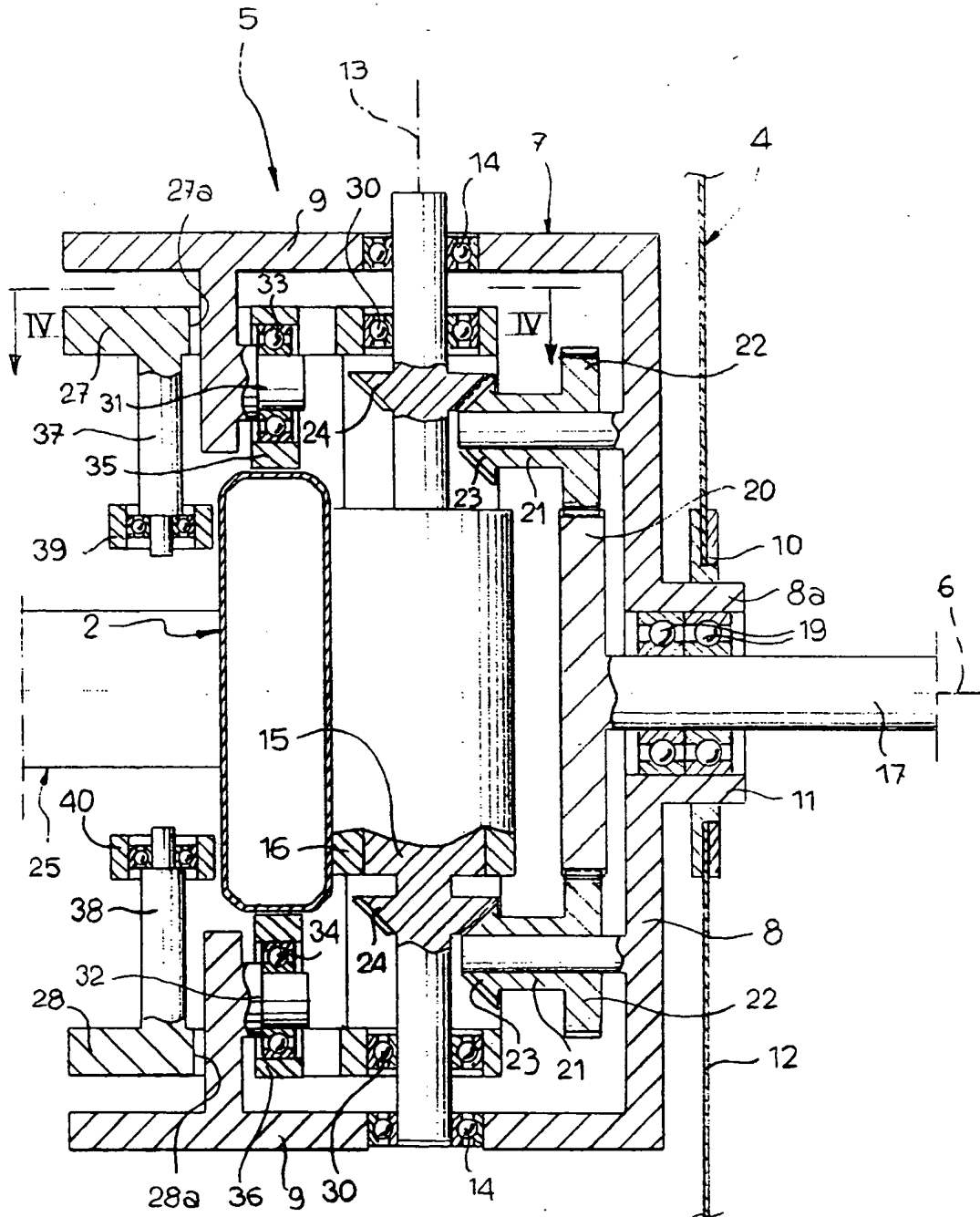
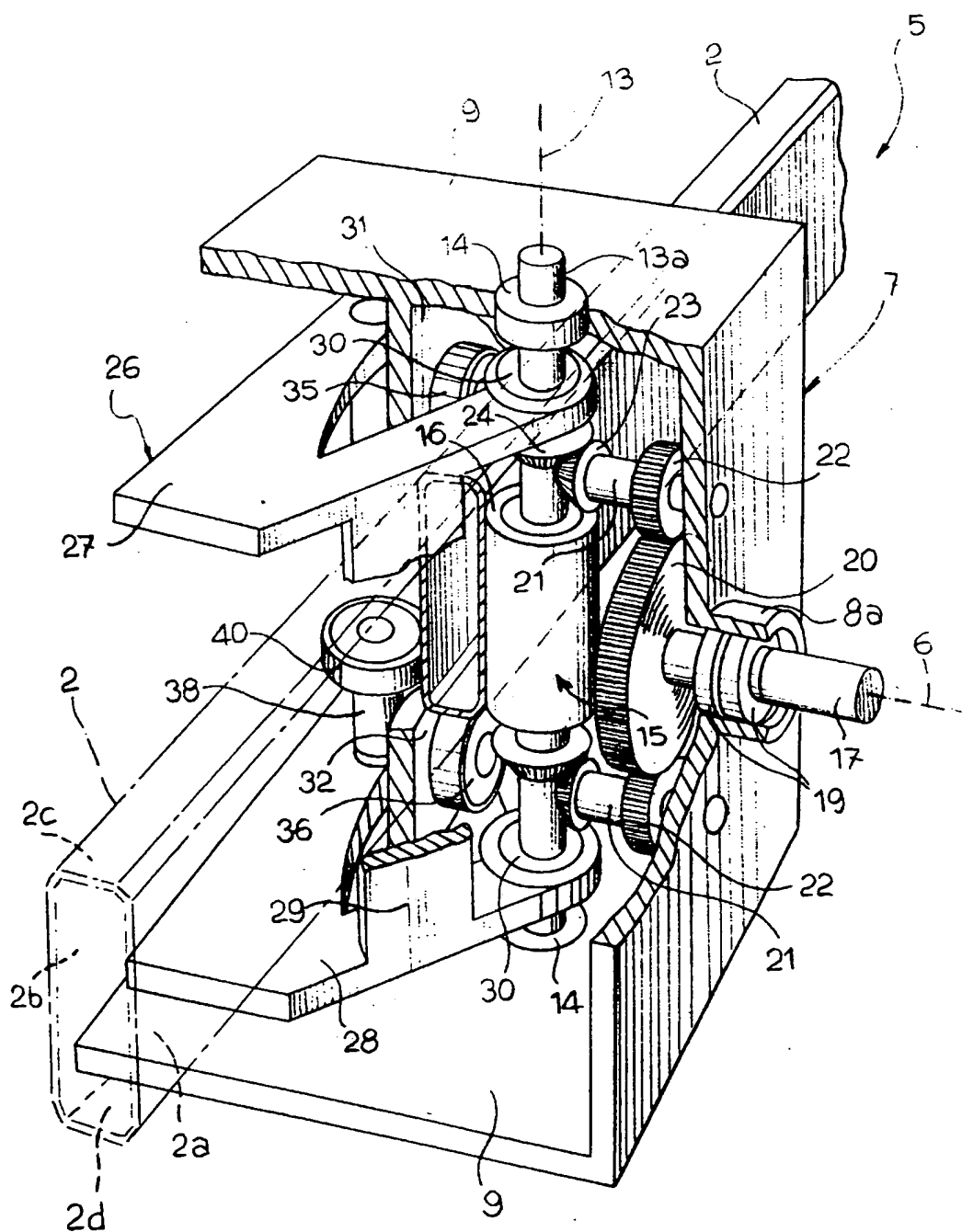
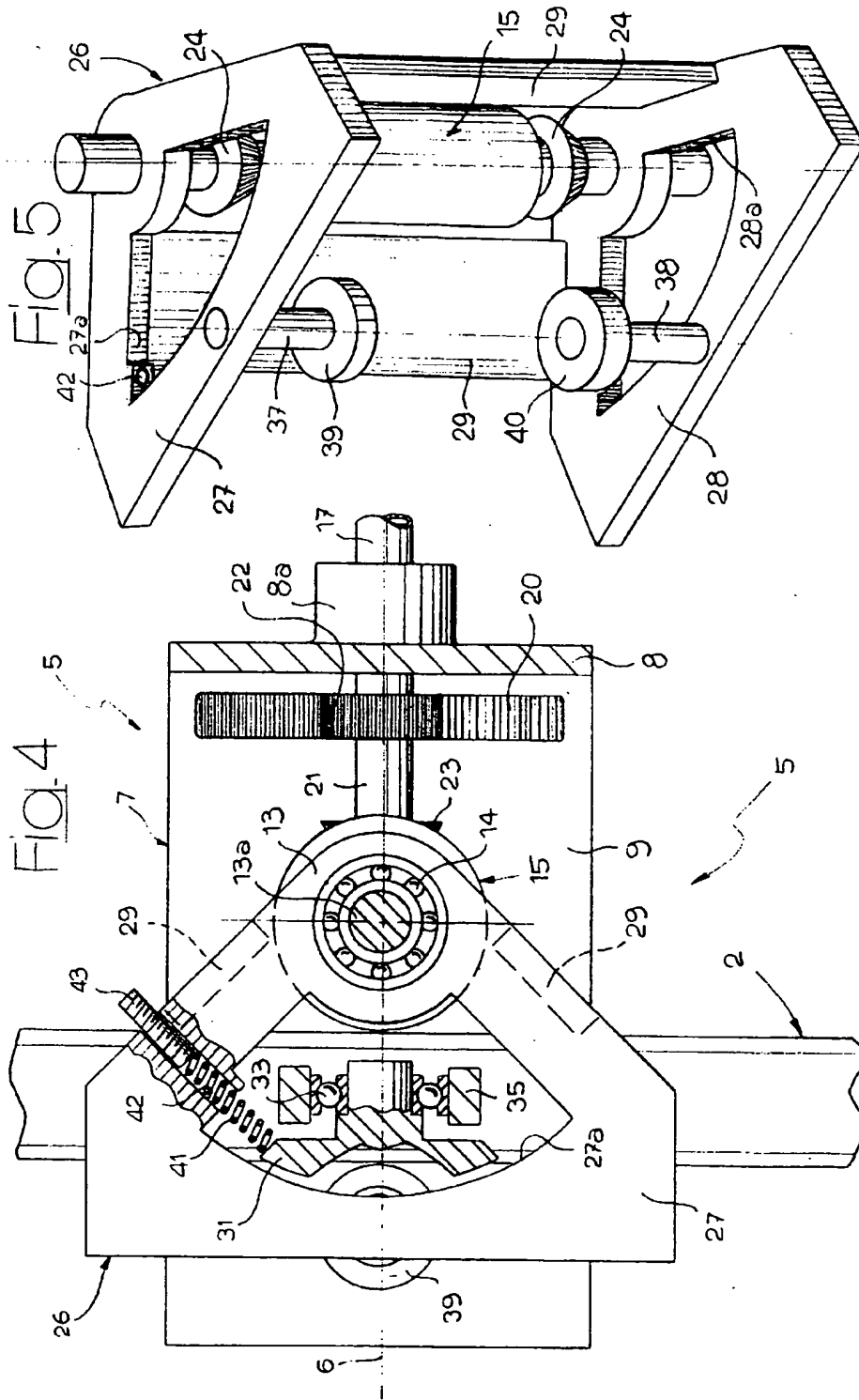


Fig. 3







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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0216

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	DE 92 11 115 U (GRASS) 12 November 1992 * page 4; figure 3 *	1-9	B66B9/08
A	LU 37 999 A (VAN DEN BEMDEN) 2 March 1960 * page 6, paragraph 4 - page 9, paragraph 2; figures 2,4 *	1-9	
A	WO 92 14673 A (HILLENKOETTER & RONSIECK) 3 September 1992 * page 10, paragraph 3 - page 11, paragraph 2; figures 14-16 *	3 1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B66B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 July 1998	Examiner Sozzi, R
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